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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/912,103	07/23/2001	Huong Thanh Nguyen	5619/DD/LOW K/JW	4476

32588 7590 07/02/2003

APPLIED MATERIALS, INC.  
2881 SCOTT BLVD. M/S 2061  
SANTA CLARA, CA 95050

EXAMINER

NGUYEN, KHIEM D

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 07/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/912,103

Applicant(s)

NGUYEN ET AL.

Examiner

Khiem D Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 10.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

***Response to Amendment***

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

The rejection of the previous Office Action are withdrawn in view of the applicant's arguments.

A new rejection is made as set forth in this Office Action.

Claims (1-20) are pending in the application.

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
2. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flanner et al. (U.S. Patent 6,410,437) and Nakane et al. (U.S. Patent 4,401,745) both previously applied in view of Liu et al. (U.S. Patent 6,323,121), newly cited.

Flanner discloses a method of fabricating a damascene structure, comprising (See col. 4, line 9 to col. 8, line 28 and FIGS. 3-21):

- (a) forming a barrier layer (FIG. 3, 14) on a substrate (FIG. 3, 16) having a metal layer (electrically conductive element) 18 (FIG. 3, 18) thereon;
- (b) forming a first organosilicate layer (FIG. 3, 12) on the barrier layer;

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(c) forming an silicon oxide layer (tetraethylorthosilicate (TEOS)) (FIG. 3, 10) on the first organosilicate layer (col. 5, lines 2-4);

(d) forming a second organosilicate layer (FIG. 3, 8) on the silicon oxide layer;

and

(e) etching the second organosilicate layer to define vias (FIG. 6, 20) therein, wherein the organosilicate layer is etched with a hydrogen-containing fluorocarbon gas mixture includes one or more gases selected from carbon tetrafluoride ( $\text{CF}_4$ ) and further includes one or more gasses selected from the group consisting of nitrogen ( $\text{N}_2$ ) and oxygen ( $\text{O}_2$ ) (col. 5, lines 51-64);

(f) etching the silicon oxide layer to transfer the vias defined in the second organosilicate layer therethrough (FIG. 6);

(g) patterning the second organosilicate layer to define interconnects therethrough, wherein the interconnects are positioned over the vias, and wherein the via pattern is transferred through the first organosilicate layer when the interconnects are defined in the second organosilicate layer; and

(g) filling the vias and interconnects with a conductive material selected from the group of copper (Cu) (col. 8, lines 22-29).

Flanner fails to explicitly disclose etching the second organosilicate layer to define vias therein, wherein the second organosilicate layer is etched with a hydrogen-containing fluorocarbon gas mixture selected from the group consisting of trifluoromethane ( $\text{CHF}_3$ ), difluoromethane ( $\text{CH}_2\text{F}_2$ ), and fluoromethane ( $\text{CH}_3\text{F}$ ).

Liu discloses etching the second organosilicate layer (FIG. 1B, 22) (col. 4, lines 34-57) to define vias (FIG. 1B, 8) therein, wherein the second organosilicate layer is etched with a hydrogen-containing fluorocarbon gas mixture (trifluoromethane ( $\text{CHF}_3$ )) (col. 5, lines 4-23). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the etching process of Liu to define vias of Flanner to avoid damaging or contaminating exposed low-k dielectric layers (col. 3, lines 34-35).

Flanner fails to explicitly disclose that the second organosilicate layer and the silicon oxide layer are etched at a temperature within the range of about  $-20^\circ\text{C}$  to about  $80^\circ\text{C}$  and are etched at a pressure within a range of about 5 mtorr to about 1 torr and further comprising applying an electric field (radio frequency (RF) power) to the hydrogen-containing fluorocarbon gas mixture selected from the group consisting of carbon tetrafluoride ( $\text{CF}_4$ ) and fluorothane ( $\text{C}_2\text{F}_6$ ) and includes one or more gases selected from the group consisting of hydrogen ( $\text{H}_2$ ), nitrogen ( $\text{N}_2$ ), oxygen ( $\text{O}_2$ ), argon (Ar), and helium (He) wherein the RF power is within a range of about  $1\text{ watt}/\text{cm}^2$  to about 100  $\text{watts}/\text{cm}^2$  as recited in present claims 8-20.

Nakane discloses etching the silicon oxide layer at a temperature of  $100^\circ\text{C}$  and at a gas pressure of 0.6 torr under the condition of applying a radio frequency (RF) power of 100 watts to the hydrogen-containing fluorocarbon gas mixture consisting of carbon tetrafluoride ( $\text{CF}_4$ ) and further includes oxygen ( $\text{O}_2$ ) (col. 10, lines 54-61). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Nakane's teaching into Flanner's method because in doing so an etching pattern faithful to a resist pattern can be obtained (col. 10, lines 54-61).

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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.  
June 27, 2003

  
